

22 December 1992

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CLAIMS

1. A crosslinked copolymer which is obtainable by polymerising a neutral diluent monomer or monomers, a zwitterionic monomer or monomers and a bifunctional or trifunctional crosslinking agent.

2. A copolymer according to claim 1 in which the diluent monomer is selected from alkyl (alk)acrylates, dialkylamino alkyl (alk)acrylates, alkyl (alk)acrylamides hydroxyalkyl (alk)acrylates, N-vinyl lactams, styrene, substituted styrene derivatives; and mixtures thereof.

3. A copolymer according to claim 2 in which the diluent monomer is selected from vinylpyrrolidone, 2-hydroxyethylmethacrylate, methylmethacrylate and mixtures thereof.

4. A copolymer according to any one of the preceding claims in which the zwitterionic comonomer or comonomers bears a centre of positive charge provided by a quaternary nitrogen atom.

5. A copolymer according to any one of the preceding claims which is obtainable by copolymerising a zwitterionic monomer of formula (I)



wherein B is a straight or branched alkylene, oxaalkylene or oligo-oxaalkylene chain or if X contains a carbon-carbon chain between B and the

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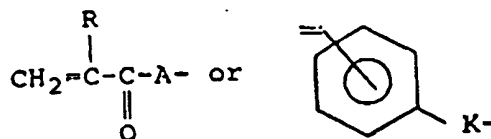
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zwitterionic group or if Y contains a terminal carbon atom,
a valence bond,

X is a zwitterionic group and

Y is an ethylenically unsaturated polymerisable

5 group selected from



wherein:

10 R is hydrogen or a C₁-C₄ alkyl group;

A is -O- or -NR¹- where R¹ is hydrogen or a C₁-C₄
alkyl group or R¹ is -B-X where B and X are as defined
above; and

15 K is a group -(CH₂)_pOC(O)-, -(CH₂)_pC(O)O-,
-(CH₂)_pOC(O)O-, -(CH₂)_pNR²-, -(CH₂)_pNR²C(O)-,
-(CH₂)_pC(O)NR²-, (CH₂)_pNR²C(O)O-, -(CH₂)_pOC(O)NR²-,
-(CH₂)_pNR²C(O)NR²- (in which the groups R² are the same or
different), -(CH₂)_pO-, -(CH₂)_pSO₃-, or, optionally in a
combination with B, a valence bond, and p is from 1 to 12
20 and R² is hydrogen or a C₁-C₄ alkyl group.

6. A copolymer according to claim 5 in which B is
an alkylene group of formula -(CR³)₂a-, wherein the groups
-(CR³)₂- are the same or different, and in each group
-(CR³)₂- the groups R³ are the same or different and each
25 group R³ is hydrogen or C₁-C₄ alkyl, and a is from 1 to
12;

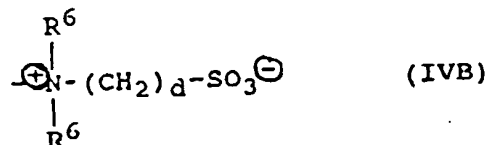
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an oxaalkylene group such as alkoxyalkyl having 1 to 6 carbon atoms in each alkyl moiety,

an oligo-oxaalkylene group of formula
 $-\{(\text{CR}^4_2)_b\text{O}\}_c(\text{CR}^4_2)_b-$ where the groups $-(\text{CR}^4_2)-$ are the same
 5 or different and in each group $-(\text{CR}^4_2)-$ the groups R^4 are the same or different and each group R^4 is hydrogen or $\text{C}_1\text{-C}_4$ alkyl, and b is 2 or 3 and c is from 2 to 11,

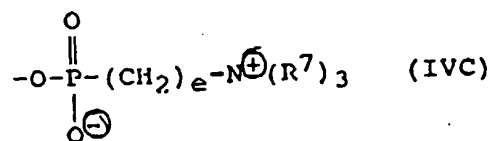
or if X contains a carbon-carbon chain between B and the centre of positive charge, or if Y contains a
 10 terminal carbon atom, a valence bond.

7. A copolymer according to claim 5 or 6 in which X is a group of formula (IVB):



15 where the groups R^6 are the same or different and each is hydrogen or $\text{C}_1\text{-C}_4$ alkyl and d is from 2 to 4;

a group of formula (IVC):



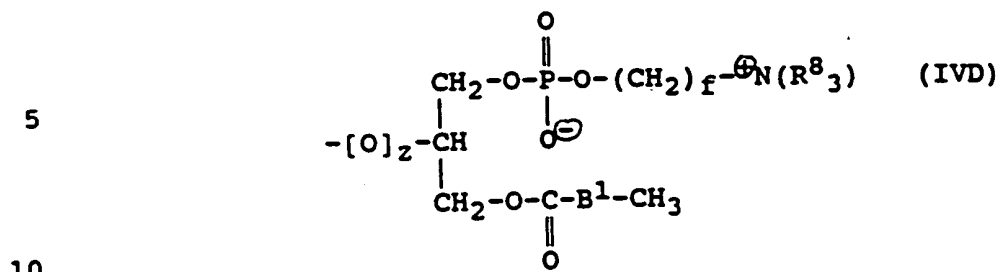
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where the groups R^7 are the same or different and each is hydrogen or $\text{C}_1\text{-C}_4$ alkyl, and e is from 1 to 4;

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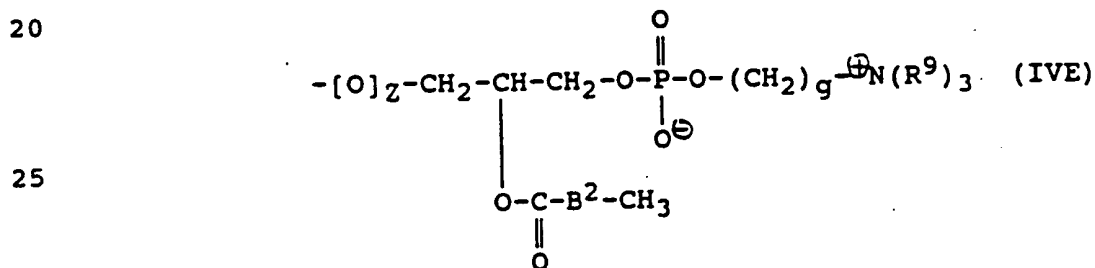
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a group of formula (IVD):



wherein the groups R^8 are the same or different and each is hydrogen or C_{1-4} alkyl, B^1 is a valence bond or straight or branched alkylene, oxaalkylene or oligo-oxalkalkylene group, f is from 1 to 4 and if B is other than a valence bond, Z is 1 and if B is a valence bond Z is 0 if X is directly bonded to an oxygen or nitrogen atom and otherwise Z is 1;

a group of formula (IVE):



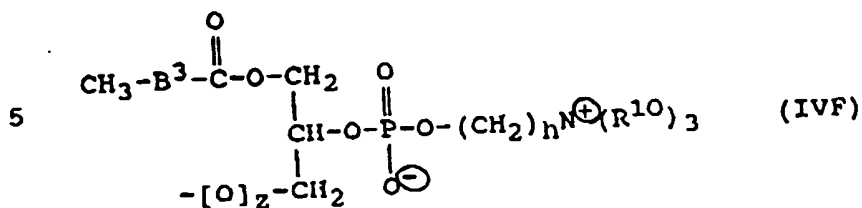
wherein the groups R^9 are the same or different and each is hydrogen or C_{1-4} alkyl, B^2 is a valence bond or a straight or branched alkylene, oxaalkylene or oligo-oxaalkylene group, g is from 1 to 4 and if B is other than a valence bond, Z is 1 and if B is a valence bond Z is 0 if X is directly bonded to an oxygen or nitrogen atom and otherwise

35 Z is 1; or

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a group of formula (IVF):



wherein the groups R^{10} are the same or different and each
 10 is hydrogen or C_1 -4 alkyl, B^3 is a valence bond or a
 straight or branched alkylene, oxaalkylene or oligo-
 oxaalkylene group, h is from 1 to 4 if B is other than a
 valence bond, z is 1 and if B is a valence bond z is 0 if X
 is directly bonded to an oxygen or nitrogen atom and
 15 otherwise z is 1.

8. A copolymer according to claim 7 in which X is
 a group of formula (IVD), (IVE) or (IVF) and B^1 , B^2 or B^3
 respectively contains up to 24 carbon atoms.

9. A copolymer according to claim 7 in which X is
 20 a group of formula (IVB) or (IVC).

10. A copolymer according to claim 9, in which
 the group X is a group of formula (IVC).

11. A copolymer according to claim 10 wherein the
 groups R^7 are all methyl.

25 12. A copolymer according to claim 11 which
 comprises residues of 2(methacryloyloxy)ethyl-2'-
 (trimethylammonium)ethyl phosphate inner salt.

13. A contact lens material comprising a copolymer
 according to any one of claims 1 to 12.

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14. A contact lens comprising a copolymer according to any one of claims 1 to 12 or a contact lens material according to claim 13.

15. A process for producing a copolymer claimed in any one of claims 1 to 12 which comprises copolymerising a monomer composition comprising a diluent monomer or monomers, a comonomer or comonomers bearing a centre of permanent positive charge, and a monomer or monomers which will crosslink the resultant polymers.

10 16. Use of a copolymer according to any one of claims 1 to 12 or a contact lens material according to claim 13 in the production of a contact lens.

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